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CASE REPORT

Percutaneous coronary intervention of a single coronary artery arising from the right sinus of Valsalva

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Summary We describe a 67-year-old woman who presented with acute lateral myocardial infarction. Coronary angiography demonstrated a single coronary artery along with the left anterior descending and left circumflex arteries that originated from proximal branches of the right coronary artery, which arose from a normal ostium in the right sinus of Valsalva. Percutaneous coronary intervention (PCI) was performed to treat 99% stenosis with a filling defect in the midportion of the left circumflex artery. This extremely rare coronary anomaly was successfully treated by PCI.

Introduction

Anomalous origin of the coronary arteries (ACA) is relatively uncommon and occurs in 0.3—2.5% of patients [1—3]. The approximate incidence of a single coronary ostium ranges from 0.03% to 0.07% [1,4,5]. Some of these ACA are clinically benign or associated with specific congenital defects, whereas others can cause myocardial ischemia, infarction, syncope, and sudden death [6]. The most commonly associated with an increased clinical risk, such as syncope, is an ectopic coronary artery arising from an inappropriate sinus of Valsalva and passing through the space between the aorta and pulmonary trunk [6]. Coronary arteries that arise from an anomalous source are not exempt from coronary atherosclerosis [7], which also can result in atherosclerotic coronary artery disease. Coronary angioplasty has been used to treat significant disease in such arteries. The presence and course of an ACA should be recognized during coronary angiography so that clinical risk can be estimated and the strategy of coronary angioplasty can be planned. We describe here a single ostium in the right sinus of Valsalva that gave rise to a right coronary artery from which the left anterior and circumflex arteries originated as separate

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branches. The patient underwent a complex coronary angioplasty to treat a stenosis in the branch of left circumflex artery.

Case report

A 67-year-old woman presented at the emergency room within 3 h of symptom occurrence. She had no history of smoking or diabetes, and no family history of premature coronary heart disease. She had undergone catheter ablation 4 months previously to treat right ventricular outflow tract ventricular tachycardia (RVOT VT). Candesartan and atorvastatin administration had resulted in good control of hypertension and dyslipidemia, respectively. A physical examination showed blood pressure, 148/83 mmHg, a heart rate of 94 bpm, no jugular venous distension, and clear lungs. Cardiac auscultation revealed normal first and second heart sounds and no murmurs. Echocardiography demonstrated hypokinesis of the lateral and posterolateral walls of the left ventricle and 12-lead electrocardiography showed ST-segment elevation in leads I, aV_L, and V3-6, as well as reciprocal depression in leads II and aV_F. Coronary angiography was performed using the transradial approach by means of the Judkins technique, but the ostium of the left coronary artery in the left sinus of Valsalva remained obscure. By using Judkins R catheter we could find the ostium of the right coronary artery (RCA). Right coronary angiography demonstrated a single coronary artery with the left anterior descending (LAD) and left circumflex arteries (LCF) originating as proximal branches of the RCA, which arose from the normal ostium in the right sinus of Valsalva (RSV). The LCF branched anterior to the RCA, arm of the Judkins R catheter was too short for the LCF angiography. We then changed to a Saito-type catheter (Create Medic, Yokohama, Japan) which has a longer arm for intubating the LCF branch. The LAD artery branched from the proximal RCA, following a course anterior to the main pulmonary artery and the right ventricular outflow tract (RVOT) to reach the mid-anterior interventricular sulcus to supply the anterior myocardium. This vessel was devoid of clinically important lesions. The RCA arose from the RSV and followed the normal pathway to the right atrioventricular sulcus. The course of the anomalous LCF was an interarterial route running between the great vessels, anterior to the aortic root and posterior to the right ventricular infundibulum at the pulmonary valvular level. The LCF supplied septal branches in the floor of the RVOT. We discovered a high-grade 99% stenosis with a filling defect in the

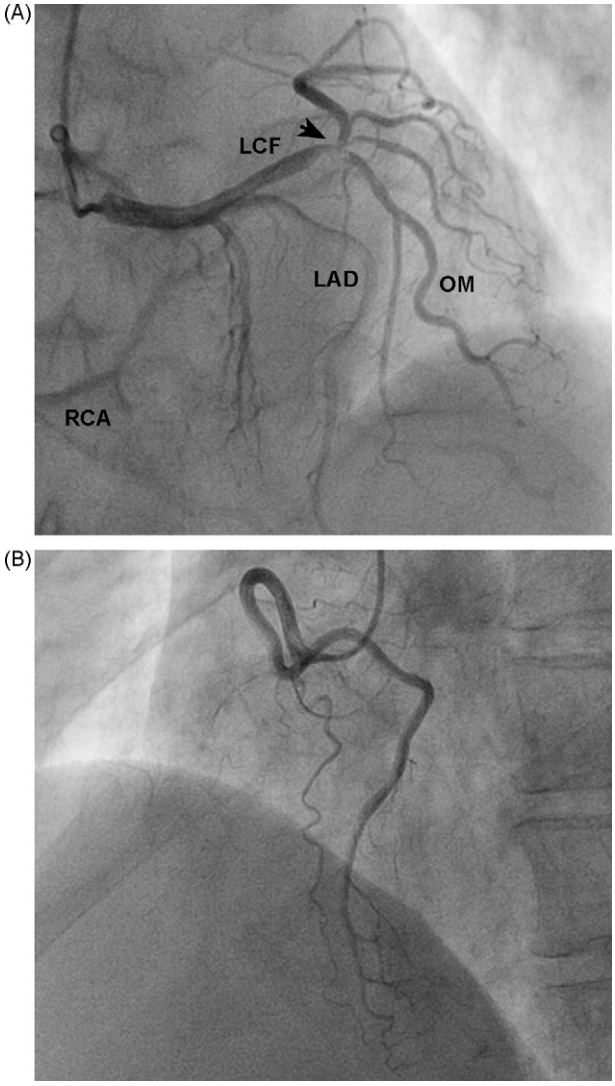

Figure 1 Coronary angiography. (A) Single coronary artery originates from the right sinus of Valsalva. Significant stenosis is evident in midportion of the LCF (arrow). (B) Selective angiography of the LAD. LA, left atrial; LCF, left circumflex artery; LAD, left anterior descending artery; RCA, right coronary artery; OM, obtuse marginal branch.

midportion of this anomalous LCF, with obtuse marginal branching from the lesion (Fig. 1). We performed PTCA to the LCF using a 6Fr Kimny mini guiding catheter (Boston Scientific, Natick, MA, USA), which was similar in shape to that used for angiography. One 0.014-in. guidewire (Balance Middleweight; Guidant Corporation, Indianapolis, IN, USA) crossed the obtuse marginal branch lesion and another (TGV3; Goodman, Nagoya, Japan) protected the LCF. The thrombectomy device (Thrombuster, Kaneka, Osaka, Japan) aspirated a small thrombus and resulted in a Thrombolysis in Myocardial Infarction (TIMI) flow grade of 3.

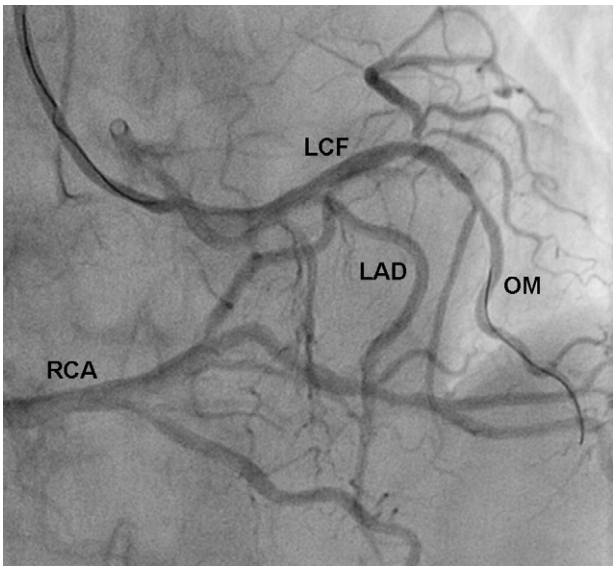

Figure 2 Coronary angiography after stent deployment. Outcome of PCI is positive. LA, left atrial; LCF, left circumflex artery; LAD, left anterior descending artery; RCA, right coronary artery; OM, obtuse marginal branch.

We then directly deployed a Liberté 2.75/16 mm stent (Boston Scientific). Angiography after stenting showed residual stenosis of <10% (Fig. 2). The maximal serum CK value was 1964 IU/L. Subsequent ECG-gated 64-row multi-slice computed tomography (MSCT) confirmed the absence of a coronary artery from the left sinus of Valsalva, detailed the anatomical findings, and confirmed the success of the PTCA. The patient's hospital course was uneventful. Electrocardiography at the time of discharge showed QS pattern in leads I, aV_L, and poor R wave progression in anterior leads. Echocardiography 3 days post-angioplasty demonstrated mild lateral hypokinesis with preserved overall left ventricular function (ejection fraction, 51%). Aspirin (100 mg/day), ticlopidine (200 mg/day), carvedilol (5 mg/day), enalapril (5 mg/day), atorvastatin (10 mg/day), and famotidine (20 mg/day) were administered and the patient was discharged 9 days after the procedure. Six months after PTCA, MSCT confirmed no restenosis of the lesion (Fig. 3). Myocardial perfusion imaging with thallium-201 also confirmed the absence of exercise-induced ischemia and she remains asymptomatic and well.

Discussion

Lipton et al. [8] proposed 3 angiographic groups of single coronary arteries based on the site of origin and the anatomical distribution of the branches. Yamanaka and Hobbs [1] further subdivided these

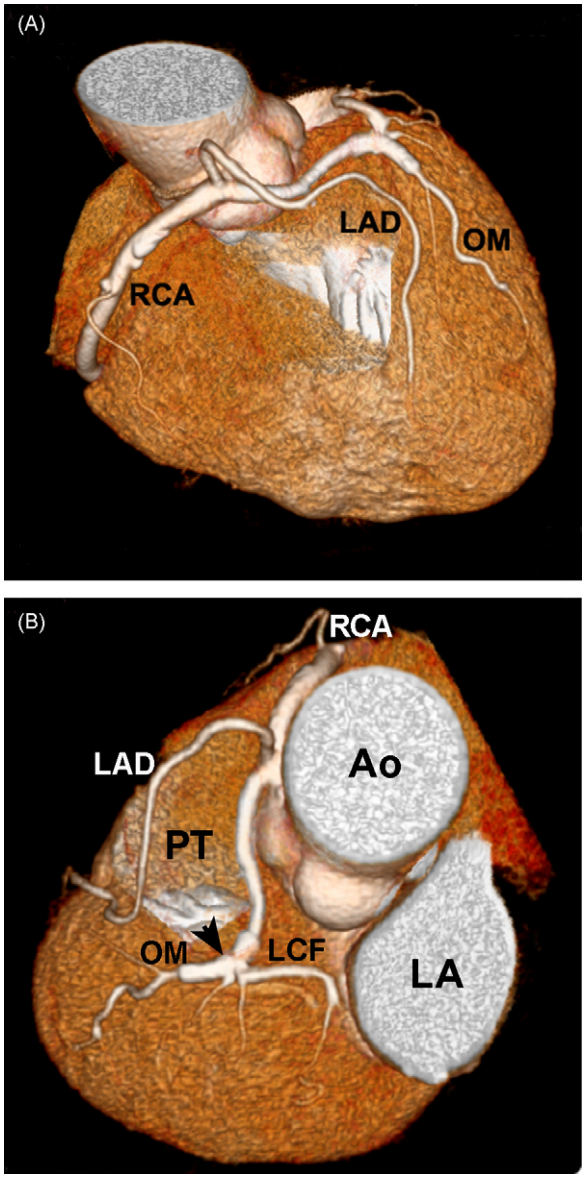

Figure 3 Three-dimensional volume-rendered reformation 6 months after PCI. (A) Anterior view of the heart. No evidence of coronary narrowing or occlusion. (B) Cranial view of the heart. No sign of lesion restenosis is evident (arrow). Ao, Aorta; PT, pulmonary trunk; LA, left atrial; LCF, left circumflex artery; LAD, left anterior descending artery; RCA, right coronary artery; OM, obtuse marginal branch.

into 5 variants according to the relationship between the anomalous coronary artery and the aorta and the pulmonary artery. Our patient fit the R-III-C type of the Yamanaka classification. Most LCF arising from the right sinus of Valsalva pass posterior to the aorta, whereas the course between the great vessels in our patient has not been described until now. Anomalous coronary arteries might be associated with an increased risk of myocardial ischemia, infarction, and sud-

den cardiac death, which could be the result of compression of the anomalous coronary artery by the aorta and pulmonary artery or a diminished vasodilation response [9]. However, even when an anomalous coronary artery does not run between the great vessels, myocardial injury or ischemia occasionally arises [10]. Patients with anomalous coronary arteries have the same or an increased risk of atherosclerotic disease [7,8] compared with those whose coronary arteries are normal. Because our patient had been asymptomatic for 67 years and a stenotic lesion with thrombus was located distal between the great vessels, atherosclerotic development was the more likely cause than compression by the great vessels. The outcome of transradial PTCA on this patient with AMI of the LCF of a single coronary artery was successful. Few reports have described successful elective angioplasty of a single anomalous coronary artery in a patient with AMI. The procedural risk of PTCA is high, because dissection of the ostium and occlusion of the single main stem could result in a catastrophic event. A major factor contributing to the success of PTCA in anomalous arteries is guiding catheter support, which was even more crucial in this patient.

We chose a Kimny mini as the guiding catheter for this patient, because the Judkins R catheter was too short for intubation. We selected longer arm catheter which is designed to cannulate both right and left coronary arteries. A stent was then delivered to the lesion. Once PTCA is selected as therapy to treat branches of ACA, the equipment should be carefully considered and experienced operators can accomplish the procedure safely and successfully. Until now, ACA has mainly been diagnosed by invasive coronary angiography, which can visualize only one coronary vessel at a time. Coronary anomalies are usually detected during coronary angiography, but spatial relationships are difficult to visualize. We used follow-up coronary CT to examine in-stent restenosis. Advancements in MSCT allow visualization of the entire course of the coronary artery and a 3-dimensional image can be obtained non-invasively [11]. Thus, MSCT should become be the new standard for evaluating anomalous coronary arteries. Our patient had a history of catheter ablation for RVOT VT, the most likely mechanism for which is catecholamine-mediated delayed after-depolarizations and triggered activity. Cardiac scintigraphy showed a normal coronary blood-flow supply to the myocardium, so we considered that the RVOT VT was unrelated to the coronary ischemia or ACA in this patient. We thank Dr Tetsuo Sonomura (Kishiwada Tokushukai Hospital) for MSCT analysis.

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We thank Dr Tetsuo Sonomura (Kishiwada Tokushukai Hospital) for MSCT analysis.

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